AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures for the month were mostly above normal with departures of moderate magnitude. (Table 1.) Relative humidity averaged close to normal and the vapor pressures were mostly above normal in harmony with the temperatures. Resultant winds for the month at the surface were mostly southerly and the velocities very light. (Table 2.) At 1,000 meters a pronounced westerly component is found and the resultant velocities range from 5 to 10 m. p. s. At 4,000 meters the resultant direction is practically due west and the velocities mostly between 10 and 15 m. p. s.

A kite record obtained at Ellendale on the 5th is of particular interest in that it showed conditions in the northeast sector of a deep LOW (29.16 at Miles City, Mont.). North-northeast surface winds (6 m. p. s.) veered to east-southeast (19 m. p. s.) at the maximum altitude (3,623 m.). Light rain was falling from A. St. clouds whose base was about 100 meters higher. The following lapse rates, (° C./100 m.) prevailed, viz., 0.88°, surface to 560 m., −7.15° to 760 m., 0.44° to 1,450 m., 0.95° to 2,500 m., and 0.77° to 3,600 m.

The principal features are the pronounced inversion between 560 and 760 meters and the abnormally steep lapse rate between 1,450 and 2,500 meters (normal, 0.54°). In marked contrast to this steep lapse rate, viz, 0.87° between 1,450 and 3,600 meters in the northeast sector of this LOW, a considerably smaller lapse rate (0.49°) occurred on the 10th when easterly winds, likewise, extended to 3,800 meters, with the A. St. base at 4,700 meters. On the latter date, however, the station was under the influence of a HIGH centered to the northeast.

Conditions of unusual interest occurred at Broken Arrow on the afternoon of the 24th in connection with the passage of a wind-shift line while a kite flight was in progress. The station was in the south sector of a deep LOW (29.24 inches North Platte) and the following note was made by Mr. P. P. Hemphill, the observer making the flight:

As the Cu. Nb. moved out the sky became visible and appeared to have a reddish tinge that seemed to be following the path of the Cu. Nb. Soon the sky was overcast with this haze or dust. The sky had the appearance of a west Texas sky just in advance of an approaching sand storm. At 3:50 p. m. the surface humidity dropped almost instantly from 72 to 19 per cent and the temperature rose 3.6° C. at the same time. The wind veered from SE. to W., backed to SW., and then veered to NW. at 7:09 p. m. This condition prevailed until between 7 and 8 p. m., when the haze began to disappear and the humidity to rise.

The dry and warm southwesterly wind in the rear of this LOW occurred at the 1,000 meter level at least one hour before it came to the surface. Surface and free-air temperatures rose from 5° to 6° C. within one hour throughout the first 1,000 meter stratum of air, with the onslaught of this westerly air, and the relative humidity dropped from saturation to between 10 and 20 per cent.

CORRECTION

In Table 1 for March, 1929, the departures indicated for the 2,000 meter level and above were inadvertently based on normals which were from 1° to 4° C. too high. This error was a result of the change beginning with that month in omitting certain intermediate levels in this table. The corrected values show small to moderate positive temperature and vapor pressure departures at practically all stations and levels and mostly negative relative humidity departures. Anyone desiring to make use of this table can obtain the corrected departures upon application to the Aerological Division, Weather Bureau, Washington, D. C.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during April, 1929*

TEMPERATURE (°C.)

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)		Washington, D. C.[1] (7 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Meters												
Surface	17.2	+1.6	17.6	+0.8	4.8	−0.8	18.5	+0.5	12.2	+1.8	16.0	+3.3
500	15.5	+1.6	16.3	+1.9	4.4	−0.8	16.7	+1.0	9.5	+1.6	12.9	+3.7
1,000	13.0	+1.5	13.5	+1.8	2.7	0.0	15.2	+1.2	6.8	+1.3	10.8	+4.3
1,500	10.7	+1.3	10.4	+1.5	1.1	+0.6	13.6	+0.8	4.0	+0.7	8.4	+4.4
2,000	8.4	+1.3	7.6	+1.6	−1.7	+0.4	11.4	+0.7	1.5	+0.6	6.0	+4.1
2,500	5.6	+1.4	5.5	+1.9	−5.0	−0.1	8.3	+0.2	−1.1	+0.6	3.6	+3.6
3,000	2.7	+1.6	2.8	+1.8	−8.3	−0.4	4.9	−0.3	−4.3	0.0	0.1	+2.7
4,000	−3.1	+1.9	−2.0	+2.2	−14.6	−0.5	−2.5	−1.4	−11.0	−1.5		
5,000							−8.7	−1.8				

RELATIVE HUMIDITY (%)

Surface	67	+3	67	+5	69	+4	77	+4	69	+4	60	0
500	67	+4	62	0	69	+5	73	+2	72	+7	57	−2
1,000	66	+6	62	+1	62	+2	60	−2	73	+11	54	−3
1,500	61	+6	63	+3	55	−2	48	−1	71	+12	57	−1
2,000	55	+5	56	−1	54	−1	40	−3	67	+10	58	+1
2,500	58	+9	51	0	53	−1	38	−3	62	+10	54	−1
3,000	48	0	49	+1	55	+1	35	−5	67	+17	54	+1
4,000	14	−31	49	+5	59	+3	35	−8	68	+19		
5,000							3	−36				

VAPOR PRESSURE (*mb.*)

Surface	13.62	+1.78	13.38	+1.30	5.86	+0.02	17.07	+1.63	10.43	+1.80	11.73	+2.30
500	12.27	+1.87	11.65	+1.09	5.71	+0.03	14.10	+1.03	9.10	+1.74	9.17	+1.69
1,000	10.30	+1.91	9.75	+0.89	4.41	−0.12	10.26	+0.12	7.66	+1.67	7.44	+1.33
1,500	8.20	+1.53	8.06	+0.89	3.61	−0.09	7.19	+0.04	6.39	+1.45	6.69	+1.36
2,000	6.16	+1.06	5.71	+0.32	3.00	+0.04	5.03	−0.32	4.58	+0.58	5.80	+1.20
2,500	5.41	+1.32	4.28	+0.34	2.41	+0.02	3.68	−0.58	3.73	+0.68	4.56	+0.90
3,000	3.76	+0.49	3.40	+0.39	2.00	+0.08	2.51	−0.92	3.21	+0.80	3.30	+0.57
4,000	0.50	−1.51	2.41	+0.57	1.44	+0.18	1.19	−1.15	1.67	+0.04		
5,000												

[1] Naval air station.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during April, 1929*

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,868 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (40 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 6 E	1.7	S 57 W	1.4	N 67 W	2.7	S 58 W	0.9	N 23 W	1.4	S 18 E	1.7	N 84 W	0.5	S 42 W	1.3	S 47 E	2.2	N 62 E	1.6
500	S 18 W	5.6	S 49 W	3.2	----------	----	S 67 W	5.1	N 19 W	1.3	S 13 E	4.9	----------	----	S 40 W	3.1	S 50 E	5.0	S 27 E	1.3
1,000	S 40 W	9.1	S 74 W	3.6	----------	----	S 85 W	7.3	N 74 W	1.8	S 6 W	3.0	S 61 W	2.9	S 45 W	3.5	S 50 E	3.2	N 64 W	0.5
1,500	S 78 W	9.3	N 74 W	5.9	----------	----	W	6.2	N 80 W	3.4	N 42 W	4.0	S 85 W	4.7	N 86 W	2.8	S 29 E	1.5	N 19 W	2.0
2,000	S 87 W	10.3	N 74 W	10.0	N 76 W	5.7	N 79 W	7.7	N 71 W	5.1	N 75 W	1.8	S 88 W	5.1	N 82 W	3.7	S 12 W	1.4	N 40 W	3.4
2,500	S 85 W	11.0	N 50 W	12.7	N 85 W	10.8	N 79 W	8.9	N 74 W	6.9	S 83 W	4.7	S 89 W	6.1	N 87 W	5.6	S 52 W	1.6	N 48 W	5.6
3,000	N 87 W	10.3	N 48 W	14.5	N 80 W	13.0	N 77 W	8.3	N 66 W	6.7	----------	----	S 88 W	6.1	S 85 W	4.3	N 76 W	1.7	N 58 W	7.7
4,000	N 83 W	12.7	N 48 W	13.6	N 69 W	12.1	N 75 W	11.3	N 60 W	8.5	----------	----	N 70 W	9.7	N 77 W	6.7	N 58 W	4.0	N 68 W	9.8
5,000	----------	----	----------	----	N 73 W	9.4	N 85 W	9.2	N 67 W	11.9	----------	----	N 83 W	9.8	N 74 W	7.9	N 60 W	6.9	----------	----

Altitude m. s. l.	Medford, Oreg. (446 meters)		Memphis Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (313 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,280 meters)		San Francisco, Calif. (60 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (67 meters)		Washington, D. C. (34 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 65 E	0.3	S 8 E	2.6	S 73 E	0.7	N 3 W	0.3	S 34 W	1.2	S 44 E	1.1	N 89 W	1.1	N 9 E	1.2	S 40 E	2.6	N 54 W	0.9
500	S 68 W	0.2	S 33 W	6.5	S 17 E	5.8	S 20 W	1.2	S 57 W	3.8	----------	----	N 78 W	3.2	N 40 E	1.6	S 22 W	2.8	N 76 W	5.4
1,000	S 76 W	1.6	S 64 W	7.8	S 21 W	5.4	S 34 W	3.4	N 84 W	5.7	----------	----	N 68 W	4.9	N 20 W	1.9	S 57 W	3.9	N 75 W	10.0
1,500	S 40 W	2.2	S 88 W	7.8	S 25 W	4.3	S 76 W	3.4	N 74 W	6.0	S 29 E	2.4	N 61 W	3.4	N 37 W	3.3	S 74 W	2.1	N 77 W	10.6
2,000	S 57 W	4.1	S 87 W	6.2	S 65 W	3.6	N 74 W	5.8	N 74 W	8.4	S 65 W	1.8	N 56 W	3.1	N 12 E	5.3	N 64 W	4.2	N 69 W	11.1
2,500	S 72 W	4.2	N 72 W	8.2	N 85 W	3.7	N 72 W	7.7	N 72 W	9.4	N 81 W	3.0	N 67 W	5.8	N 19 E	3.6	N 60 W	4.0	N 66 W	10.6
3,000	S 75 W	5.1	N 64 W	10.0	N 89 W	5.4	N 74 W	10.2	N 65 W	11.6	N 76 W	6.2	N 65 W	7.0	N 10 W	6.2	N 61 W	4.1	N 79 W	10.4
4,000	----------	----	----------	----	S 86 W	6.8	N 80 W	14.9	----------	----	N 80 W	8.0	S 89 W	7.5	----------	----	----------	----	----------	----
5,000	----------	----	----------	----	N 70 W	9.0	----------	----	----------	----	----------	----	----------	----	----------	----	----------	----	----------	----

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WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL CONDITIONS

April, 1929, like the preceding month, continued moderately warm over most districts from the Rocky Mountains eastward and also like March it continued cool to the westward. The precipitation was generally greater than normal, except over portions of the Southwest and near-by areas in the west Gulf section and locally in some other small areas, aggregating about one-fourth of the country with precipitation less than normal.

PRESSURE AND WINDS

The month opened with a well-defined cyclonic storm central over lower Michigan, attended by heavy snows or rains and snows over portions of the Lake region and upper Mississippi Valley and by precipitation generally from the middle and northern Plains eastward to the Appalachian Mountains, continuing during the following day into the more northeastern States. Generally fair weather prevailed thereafter until the 4th, when rain set in over the Pacific Coast States, extending during the 5th into most districts to westward of the Rocky Mountains and changing to snow in some of the elevated districts. At the same time conditions favoring local thunderstorms overspread the region from the Ohio Valley and eastern Lake region to the middle Atlantic coast, continuing over some of this area during the following day and extending westward into the upper Mississippi Valley and portions of the Northwest, the western precipitation area having largely broken up on reaching the Great Plains.

At the a. m. observation of April 8, thunderstorm conditions existed over a narrow area from the lower Rio Grande Valley northeastward to the Great Lakes, attended by local heavy rains in portions of Missouri and Texas, and during the following 24 hours the rain area extended slightly eastward, the heavy falls occurring mostly in eastern Texas and portions of the lower Mississippi Valley. During this period low barometric pressure was developing in the far Southwest and by the morning of the 10th it had extended to the southern Plains, while the area favorable to thunderstorms had advanced to North Carolina, and at 8 a. m. of the 10th precipitation had overspread a wide area from the northern and central mountains southeastward nearly or quite to the middle and south Atlantic coasts, considerable snow occurring over the mountain States with more or less heavy rains in the Ohio Valley. The eastern precipitation area practically disappeared by the 11th, but the center of the Plains area had moved northeastward to the upper Mississippi Valley and local rains continued over wide areas in the central valleys and toward the Atlantic coast.

During the following 24 hours, local rains continued in the Lake region and generally from the middle Gulf eastward to the Atlantic coast and thence northward to southern New England, the storm disappearing during the following day to northward of the Great Lakes with some snow occurring in the northern portions of New York and New England.

About the 14th and 15th precipitation overspread considerable portions of the far Northwest and at the same time cyclonic conditions developed in the Southwest, which, by the morning of the 15th, had reached the Middle Gulf States and heavy rains had occurred locally in the area affected. This storm moved to the immediate middle Atlantic coast by the 16th and heavy rains had extended into portions of this area, the precipitation area passing off the New England coast attended by local snows in the elevated regions of the Northeastern States.

After a considerable period without important precipitation over the Pacific coast, about the 19th and during